

a part. It is now evident that the tendency to retain the megasporangium within the sporangium, and to continue to nourish the gametophyte and also its offspring, the sporophyte, through the sporangium until the young sporophyte is provided with sufficient food in reserve to enable it to begin life on its own account with a fair prospect of success, resulting in the production of the seed, has originated in widely different types, and therefore on independent lines. Thus the true significance of the seed, as an adaptation to secure the fuller possession of the earth's surface, and to escape the dangers of dependence on water for the fertilisation of the egg-cell, has become realised. A new era in botany opened with the recognition of the common ancestry of ferns and cycads, based on similarities in their structure, by the discovery that supposed ferns of the Carboniferous strata produced true seeds resembling those of cycads in important respects, and on the not less startling discovery, which we owe to Japan, of the ciliated male cells in the pollen of *Ginkgo* and of the cycads. Of these and other great advances in recent years, such as in the knowledge of the Cycadeoidea, Dr. Lotsy gives a very clear account, which should be most helpful to students.

The vascular plants possessed of ciliated sperms, the Zoidogamia, he divides into two great groups characterised by the sperm-cells, which possess two cilia in the Lycopodineæ and their allies, and many cilia in the Filicineæ and seed-formers. He points out that this agrees with the groups based by Lignier on the structure of the leaves. Heterospory has been attained independently in several lines of descent in both these groups, and is thus no certain proof of close relationship among plants in which it occurs. His arrangement is in several respects a good deal different from that in use in English text-books, both in the relations of the larger divisions and in such minor details as breaking up Hydropterideæ and placing Marsiliaceæ beside Schizæaceæ, and Salviniaceæ beside Hymenophyllaceæ, among the leptosporangiate filices.

On similar grounds *Selaginella* is brought back to Lycopodiaceæ, while *Isoetes* is placed between the Equisetaceæ and Filices, because of its polyciliate male cells and of the development of its spores and embryo. The present state of knowledge with regard to the structure and life-histories of the Lycopodiaceæ and their allies is in striking contrast to that of not many years back; and of this advance the author gives a good account. The relations of the alliance to other groups can now be estimated in a truer light than was formerly possible. Though certain types within it had advanced far on the way to the formation of seeds, there is no clear evidence pointing to the descent from them of any existing seed-plants.

The lectures treating of the ferns and their allies are of very special interest, in view of the ever-increasing evidence connecting them with the descent of the seed-plants. While the progress during the past decade has been very great, and has revolutionised former beliefs, it has shown also that the production of seeds had already been attained at a period so far back in geological history as to make it very improbable that direct proof of the lines of evolution will

be obtained. But while great problems will probably remain unsolved in detail, the general trend of progress has become evident, and there is reason to anticipate that the rate of advance will not slacken; though it seems scarcely likely that there can be many future discoveries so startling as those already alluded to.

The grouping of the leptosporangiate ferns takes full account of Prof. Bower's researches on the sporangia. The eu-sporangiate types, like the leptosporangiate, are derived from the Primo-filices, by separate lines of descent. The Pteridospermeæ are probably more nearly related to Marattiaceæ than to any other existing ferns, but over a very wide gap. The concluding lectures of this volume treat of the Cordaitales, Bennettiales, Cycadales living and extinct, and Ginkgoaceæ. They present subjects of extreme interest, and of the utmost importance in tracing the development of the higher plants.

Those who read this volume will feel that while it demands close attention, and while some of the lectures are of value for reference on subordinate groups rather than for questions of wider interest, the work well repays the attention necessary, and that the aim, kept steadily in view, has been successfully attained, to supply an unbiased and worthy representation of what is at present known with regard to the groups of plants discussed. The information brought together within its compass has been gathered from a vast field; and the sources from which it has been taken are scrupulously indicated, as regards both text and the excellent and copious illustrations, which do much to aid the exposition, clear though that is. We cannot but feel that it is more useful in its present form, available to be read and re-read, than it could be as a course of lectures. It must prove a great boon to students desirous to obtain an adequate guide to the researches of recent years, in a form that can permit of use as a work of constant reference, from which they may gain wider views of the science of botany.

The third volume, on siphonogamous seed-plants, will be most welcome, though it can scarcely deal with subjects of such interest, or so full of the charm of advancing knowledge. The standard of the two volumes already published is a guarantee for the expectation that it will be a most valuable addition to every botanical library.

UTILISATION OF PEAT.

Commercial Peat: its Uses and Possibilities. By F. T. Gissing. Pp. x+191. (London: Charles Griffin and Co., Ltd., 1909.) Price 6s. net.

IN this volume on peat, which is a companion one to that published in 1907 by Messrs. Björling and Gissing, the author's aim is the description, from a commercial point of view, of the various processes proposed for the utilisation of peat.

In pursuance of this object Mr. Gissing describes fully the preparation from peat of alcohol, moss litter, and paper, the cutting and drying of peat, and the manufacture of press turf and of machine turf, but the greater part of the book deals with the products got by the destructive distillation of peat.

The book is clearly written, contains many interesting illustrations, and, when taken in conjunction with Messrs. Björling and Gissing's work, forms a very complete descriptive account of the peat industries. Occasionally, however, the author, carried away by his enthusiasm for the utilisation of peat, refrains from directing attention to the more obvious defects in some of the schemes put forward, and leaves the capitalist in ignorance of facts which might materially alter the latter's relations to the projected industries.

The many attempts made within the past ten years to utilise our peat supplies have proceeded in three main directions, viz. the conversion of peat into fuel, the manufacture of power gas from peat, and the utilisation of peat fibres for the manufacture of paper, alcohol, moss litter, &c.

The chief difficulties attending the conversion of peat into fuel on a commercial scale are the removal of the large amount of water contained in freshly cut peat and the increase of the low specific calorific power, *i.e.* the calorific power of unit volume, of the fuel. The removal of the water by mechanical methods (hydraulic pressure, centrifuging, &c.), and also its removal by artificial heating, have been shown again and again to be unremunerative, and no process in which any of these methods forms a constituent part can, with normal prices prevailing for rival fuels, be regarded as economically sound. The only method for removing the water which has proved commercially successful is the method of air-drying employed by farmers for the production of their turf.

The specific calorific power of turf can be increased by converting the peat into press turf or into machine turf, but the difficulty of drying the product in a moist climate like that of Ireland, and the high cost of transport, render it unlikely that turf will displace coal as a fuel from any districts other than those in the immediate neighbourhood of peat bogs.

The manufacture of producer gas and its employment in industries such as the fabrication of glass, as well as the production of power gas and the recovery of the ammonia simultaneously formed, may under carefully selected conditions be made remunerative, but peat cannot, under any conditions likely to arise in the near future, become so cheap a source of energy as coal at the pit-mouth in England.

It is unlikely that the conversion of peat fibres into paper or into alcohol will prove successful commercially. From one ton of anhydrous, light, surface peat, by hydrolysis about 0·28 ton of reducing sugars can be obtained, and if the latter were all fermentable they would afford about forty gallons of alcohol. If this were the average yield of alcohol from peat the process would be very remunerative, but, unfortunately, about one-half the amount of sugars in hydrolysed peat consists of pentoses which are not capable of undergoing *saccharomyces* fermentation, and consequently the yield of alcohol rarely exceeds twenty gallons per ton of dry peat; if surface peat is not employed in the manufacture, the yield may fall so low as five gallons per ton. If the yield of alcohol from a given speci-

men of peat falls below sixteen gallons per ton, the manufacture of "peat spirit" will be unable to compete with that of "potato spirit" owing to the greater value of the by-products in the latter industry. The peat moss-litter industry, on the other hand, is from the commercial point of view the most flourishing of all the peat industries, and is likely to prove as remunerative to the capitalist in the future as it has been in the past.

HUGH RYAN.

THE HEALTH OF THE SCHOOL CHILD.

The Hygiene of School Life. By Dr. Ralph H. Crowley. Pp. xiv+403. (London: Methuen and Co., 1910.) Price 3s. 6d. net.

In his preface to this work the author states that it was written while he was medical superintendent to the Bradford Education Authority, and that the conclusions arrived at and the measures advocated are based upon his own practical experience gained amongst the schools and school-children of that city. He furthermore states that the views expressed receive no added sanction from the fact that he now holds an official position in the Medical Department of the Board of Education. Although this may be so, it seems as if his present position is responsible (through the official non-committal attitude it has engendered) for the one outstanding deficiency of the book, namely, a lack of definiteness and of detail. For instance, one who consults a manual upon the hygiene of school-life might reasonably expect some definite directions upon the cleansing and disinfection of school premises; the measurements of seats and desks for children in different age groups, with the appropriate slope of desks for reading and writing purposes; the distances recommended between the hanging-pegs of cloak-rooms; but in these respects, as in so many others, he will find but generalities. Indeed, generally speaking, the work is sketchy, and requires the addition of fuller and often more definite information to become a useful addition to the already voluminous literature upon the subject of school hygiene.

It need scarcely be said that the matter given and the views expressed by one with the experience and knowledge of Dr. Crowley are sound, and that certain parts of the work reach a good standard of merit; more especially is this true of the chapters upon special groups of school-children. The chapter upon medical inspection of the child in the school is also very good, and it impresses upon the reader the fact that medical inspection, and all that it involves, has a part to play now and in the future, the importance of which can hardly be over-estimated. As Dr. Crowley states in his introduction, it is a service which stands out clear and well-defined, demanding of the medical men and women who perform it the highest qualifications and attainments. While essentially a part of the public health service, it is nevertheless a department which can never know its own full development until it recognises itself as a part of the whole public health service of the country, and links itself up and has an organic relation with that